REMARKS

Applicants wish to express appreciation to Examiners Virginia M. Kibler and Mehrdad Dastouri for the courtesy of an interview, which was granted to Applicants' representative Sanford T. Colb (Reg. No. 26,856). The interview was held at the USPTO on 26 February 2004. The substance of the interview is set forth in the Interview Summary, numbered Paper No. 5. The present amendment is intended to be fully responsive to all points of rejection raised by the Examiner, and is believed to place the application in condition for allowance.

Claims 1 – 87 are pending in the application.

Claims 1, 25, 29, 31, 34, 35, 44, 72, 74, 77 and 78 are currently amended.

No new matter has been added. Support for the amendments can be found, *inter alia*, in Fig. 1 and Fig. 3, and in paragraphs [110], [115] and [116] of the written description.

Favorable reconsideration and allowance of all claims under consideration is respectfully requested.

Claims Objections

Claims 25, 35 – 41 and 78 – 85 stand rejected because of various linguistic informalities, pointed out by the Examiner. These informalities have been appropriately corrected. Similar informalities were found in claims 31, 34, 74 and 77 and corrected. In view of the foregoing, Applicants, therefore, respectfully request that the Examiner withdraw these objections to the claims.

Claims Rejections – 35 U.S.C. § 102 – Hara

Claims 1, 2, 24, 25, 44, 45, and 67 stand rejected under 35 U.S.C. §102 (b) as being anticipated by Hara et al. (U.S. 4,692,690). Applicants respectfully traverse the above rejection as applied to each rejected claim.

Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light.

Claim 1 has been amended and includes, *inter alia*, the following distinguishing recitation:

> obtaining first image data relating to at least a part of an electrical circuit;
>
> obtaining second image data generally corresponding to said part of an electrical circuit, said second image data including at least some image data that is different from said first image data;
>
> modifying said first image data by employing said second image data thereby to produce an enhanced representation of the electrical circuit; and
>
> inspecting the enhanced representation with reference to a reference representation of the electrical circuit to detect defects in the electrical circuit.

As noted above, Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light. The images are processed and compared to each other to detect pattern defects on the basis of a difference between the respective fluorescent and infra-red reflectance images.

Hara et al. fails to show or suggest modifying first image data by employing second image data thereby to produce an enhanced representation of the electrical circuit, and inspecting the enhanced representation with reference to a reference representation of the electrical circuit to detect defects in the electrical circuit.

In view of the foregoing, Applicants respectfully submit that claim 1, as amended, is deemed patentable over Hara et al. Applicants respectfully request that the Examiner withdraw this rejection of claim 1.

Claims 2, 24 and 25 depend, directly and indirectly, from claim 1. Inasmuch as claim 1 is deemed patentable, Applicants respectfully submit that claims 2, 24 and 25 are also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 2, 24 and 25.

With respect to claim 44, claim 44 has been amended and now includes, *inter alia*, the following distinguishing recitation:

> *a first image data acquisition assembly obtaining first image data relating to at least a part of an electrical circuit;*
>
> *a second image data acquisition assembly obtaining second image data generally corresponding to said part of said electrical circuit, said second image data including at least some image data that is different from said first image data;*
>
> *a first image data modifier modifying said first image data by employing said second image data thereby to produce an enhanced representation of the electrical circuit; and*
>
> *a defect inspector, inspecting the enhanced representation with reference to a reference representation of the electrical circuit to detect defects in the electrical circuit.*

As noted above, Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light. The images are processed and compared to each other to detect pattern defects on the basis of a difference between the respective fluorescent and infra-red reflectance images.

Hara et al. fails to show or suggest an image data modifier modifying first image data by employing second image data thereby to produce an enhanced representation of an electrical circuit, and then inspecting the enhanced representation with reference to a reference representation of the electrical circuit to detect defects in the electrical circuit.

In view of the foregoing, Applicants respectfully submit that claim 44, as amended, is deemed patentable over Hara et al. Applicants respectfully request that the Examiner withdraw this rejection of claim 44.

Claims 45 and 67 depend from claim 44. Inasmuch as claim 44 is deemed patentable, Applicants respectfully submit that claims 45 and 67 are also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 45 and 67.

Claims Rejections - 35 U.S.C. § 103 - Hara and Caspi

Claims 3 - 23, 26, 27, 31, 32, 34 - 43, 46 - 66, 69, 70, 74, 75 and 77 - 87 stand rejected under 35 U.S.C. §103 (a) as being unpatentable over Hara et al. (U.S. 4,692,690) in view of Caspi et al. (U.S. 5,774,573). Applicants respectfully traverse the above rejection as applied to each rejected claim.

Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light.

Caspi et al. describes an automatic visual inspection system that produces a binary bit map of an object at a resolution greater than the resolution of an acquired gray scale image of the object.

Claims 3 - 23 depend, directly and indirectly, from claim 1. Claim 1 has been amended to address rejection under 35 U.S.C. §102 (b) as being anticipated by Hara et al., for reasons

advanced above. Inasmuch as claim 1 is deemed patentable, Applicants respectfully submit that claims 3 – 23 are also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 3- 23.

With respect to claim 26, claim 26, as originally submitted, includes *inter alia* the following distinguishing recitation:

> *obtaining first image data relating to at least part of an electrical circuit in at least a first spectral range;*
>
> *obtaining second image data relating to at least part of an electrical circuit in at least a second spectral range; and*
>
> *providing an enhanced contrast representation of the electrical circuit by non-linearly combining said first image data and said second image data .*

As noted above, Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light. The images are processed and compared to each other to detect pattern defects on the basis of a difference between the respective fluorescent and infra-red reflectance images. Caspi et al. describes an automatic visual inspection system that produces a binary bit map of an object at a resolution greater than the resolution of an acquired gray scale image of the object. The improvement in resolution is obtained by determining a sub-pixel location of edges by convolving a gray level image with an approximation of the second derivative of a two-dimensional Gaussian function. In the vicinity of edges, linearly interpolated zero-crossings between positive and negative pixel values in the convolved image indicate a precise edge location. Pixels suitable for identifying edges are determined by a threshold test.

Nothing in the combination of Hara et al. and Caspi et al. shows or suggests providing an enhanced contrast representation of an electrical circuit by non-linearly combining first image data and second image data. In view of the foregoing, Applicants respectfully request that the Examiner withdraw this rejection of claim 26.

Claim 27 depends from claim 26. Inasmuch as claim 26 is deemed patentable, Applicants respectfully submit that claim 27 is also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claim 27.

With respect to claim 31, claim 31, as originally submitted, includes *inter alia* the following distinguishing recitation:

> *obtaining first image data relating to at least part of an electrical circuit;*
>
> *obtaining second image data relating to at least part of an electrical circuit; and*
>
> *non-linearly combining said first image data and said second image data to form a pseudo image, and supplying said pseudo-image to a high-sure/low-sure region classifier.*

As noted above, Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light. The images are processed and compared to each other to detect pattern defects on the basis of a difference between the respective fluorescent and infra-red reflectance images. Caspi et al. describes an automatic visual inspection system that produces a binary bit map of an object at a resolution greater than the resolution of an acquired gray scale image of the object. The improvement in resolution is obtained by determining a sub-pixel location of edges by convolving a gray level image with an approximation of the second derivative of a two-dimensional Gaussian function. In the vicinity of edges, linearly interpolated zero-crossings

between positive and negative pixel values in the convolved image indicate a precise edge location. Pixels suitable for identifying edges, namely low-sure pixels, are determined by a threshold test.

Nothing in the combination of Hara et al. and Caspi et al. shows or suggests non-linearly combining first image data and second image data to form a pseudo image, and supplying the pseudo-image to a high-sure/low-sure region classifier. In particular, nothing in Hara et al. anticipates non-linear image enhancement, and the high-sure/low-sure region classifier of Caspi employs a straightforward threshold test. In view of the foregoing, Applicants respectfully request that the Examiner withdraw this rejection of claim 31.

Claims 32 and 34 – 43 depend, directly and indirectly, from claim 31. Inasmuch as claim 31 is deemed patentable, Applicants respectfully submit that claims 32 and 34 – 43 are also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 32 and 34 – 43.

Claims 46 – 66 depend, directly and indirectly, from claim 44. Claim 44 has been amended to address rejection under 35 U.S.C. §102 (b) as being anticipated by Hara et al., for reasons advanced above. Inasmuch as claim 44 is deemed patentable, Applicants respectfully submit that claims 46 – 66 are also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 46 - 66.

With respect to claim 69, claim 69, as originally submitted, includes *inter alia* the following distinguishing recitation:

> *a first image data acquisition assembly, obtaining first image data relating to at least part of an electrical circuit in at least a first spectral range;*

a second image data acquisition assembly obtaining second image data relating to at least part of an electrical circuit in at least a second spectral range; and

an enhanced contrast representation generator providing an enhanced contrast representation of the electrical circuit by non-linearly combining said first image data and said second image data .

As noted above, Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light. The images are processed and compared to each other to detect pattern defects on the basis of a difference between the respective fluorescent and infra-red reflectance images. Caspi et al. describes an automatic visual inspection system that produces a binary bit map of an object at a resolution greater than the resolution of an acquired gray scale image of the object. The improvement in resolution is obtained by determining a sub-pixel location of edges by convolving a gray level image with an approximation of the second derivative of a two-dimensional Gaussian function. In the vicinity of edges, linearly interpolated zero-crossings between positive and negative pixel values in the convolved image indicate a precise edge location. Pixels suitable for identifying edges are determined by a threshold test.

Nothing in the combination of Hara et al. and Caspi et al. shows or suggests an enhanced contrast representation generator providing an enhanced contrast representation of an electrical circuit by non-linearly combining first image data and second image data. In view of the foregoing, Applicants respectfully request that the Examiner withdraw this rejection of claim 69.

Claim 70 depends from claim 69. Inasmuch as claim 69 is deemed patentable, Applicants respectfully submit that claim 70 is also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claim 70.

With respect to claim 74, claim 74, as originally submitted, includes *inter alia* the following distinguishing recitation:

> *a first image data acquisition assembly, obtaining first image data relating to at least part of an electrical circuit;*
>
> *a second image data acquisition assembly obtaining second image data relating to at least part of an electrical circuit; and*
>
> *a pseudo-image generator non-linearly combining said first image data and said second image data, said pseudo-image generator being operative to supply a pseudo-image of said part of said electrical circuit constructed from said first and second image data to a high-sure/low-sure region classifier.*

As noted above, Hara et al. describes a pattern detecting apparatus for inspecting a printed wiring board employing a fluorescent image and an image formed by reflected infra-red light. The images are processed and compared to each other to detect pattern defects on the basis of a difference between the respective fluorescent and infra-red reflectance images. Caspi et al. describes an automatic visual inspection system that produces a binary bit map of an object at a resolution greater than the resolution of an acquired gray scale image of the object. The improvement in resolution is obtained by determining a sub-pixel location of edges by convolving a gray level image with an approximation of the second derivative of a two-dimensional Gaussian function. In the vicinity of edges, linearly interpolated zero-crossings between positive and negative pixel values in the convolved image indicate a precise edge location. Pixels suitable for identifying edges, namely low-sure pixels, are determined by a threshold test.

Nothing in the combination of Hara et al. and Caspi et al. shows or suggests a pseudo-image generator non-linearly combining first image data and second image data, the pseudo-image generator being operative to supply a pseudo-image of a part of an electrical circuit constructed from the first and second image data to a high-sure/low-sure region classifier. In particular, nothing in Hara et al. anticipates non-linear image enhancement, and the high-sure/low-sure region classifier of Caspi employs a straightforward threshold test. In view of the foregoing, Applicants respectfully request that the Examiner withdraw this rejection of claim 74.

Claims 75 and 77 – 87 depend, directly and indirectly, from claim 74. Inasmuch as claim 74 is deemed patentable, Applicants respectfully submit that claims 75 and 77 – 87 are also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 75 and 77 - 87.

Claims Rejections – 35 U.S.C. § 103 – Elyasaf and Caspi

Claims 29, 30, 72 and 73 stand rejected under 35 U.S.C. §103 (a) as being unpatentable over Elyasaf et al. (U.S. 6,175,645) in view of Caspi et al. (U.S. 5,774,573).

Elyasaf et al. describes optical inspection method and apparatus employing a first beam reflected from the upper face of an object, and a second beam which is transmitted through the upper and lower faces of a non-opaque object, both beams being simultaneously sensed. The object is an electrical circuit formed only on one side of a substrate.

Caspi et al. describes an automatic visual inspection system that produces a binary bit map of an object at a resolution greater than the resolution of an acquired gray scale image of the object. While the electrical circuit may be formed on both sides of a substrate, the substrate is opaque.

Claim 29 is currently amended and now includes, *inter alia*, the following distinguishing recitation:

> *obtaining image data relating to at least part of an electrical circuit, said electrical circuit being formed on both sides of a non-opaque substrate, said image data including artifacts resulting from a non-opaque characteristic of the substrate; and*
>
> *enhancing said image data to provide enhanced inspection output information which decreases said artifacts in said image data.*

Applicants respectfully submit that nothing in the combination of Elyasaf and Caspi shows or suggests obtaining image data relating to at least part of an electrical circuit which is formed on both sides of a non-opaque substrate. Consequently, there is no suggestion in either of Elyasaf or Caspi, or in their combination, of acquiring image data including artifacts resulting from the non-opaque characteristic of the substrate, nor is there any teaching of enhancing the image data to decrease such artifacts. In view of the foregoing, Applicants respectfully request that the Examiner withdraw this rejection of claim 29.

Claim 30 depends from claim 29. Inasmuch as claim 29 is deemed patentable, Applicants respectfully submit that claim 30 is also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claim 30.

With respect to claim 72, claim 72 is currently amended and now includes, *inter alia*, the following distinguishing recitation:

> *an image data acquisition assembly obtaining image data relating to at least part of an electrical circuit, said electrical circuit being formed on both sides of a non-opaque substrate, said image data including artifacts resulting from a non-opaque characteristic of the substrate; and*

an image data enhancement assembly, enhancing said image data to provide enhanced inspection output information which decreases said artifacts in said image data.

Applicants respectfully submit that nothing in the combination of Elyasaf and Caspi shows or suggests obtaining image data relating to at least part of an electrical circuit which is formed on both sides of a non-opaque substrate. Consequently, there is no suggestion in either of Elyasaf or Caspi, or in their combination, of acquiring image data including artifacts resulting from the non-opaque characteristic of the substrate, nor is their any teaching of enhancing the image data to decrease such artifacts. In view of the foregoing, Applicants respectfully request that the Examiner withdraw this rejection of claim 72.

Claim 73 depends from claim 72. Inasmuch as claim 72 is deemed patentable, Applicants respectfully submit that claim 73 is also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claim 73.

Claims Rejections - 35 U.S.C. § 103 - Hara, Caspi and Elyasaf

Claims 28, 33, 71 and 76 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hara et al. (U.S. 4,692,690), in view of Caspi et al. (U.S. 5,774,573) and further in view of Elyasaf et al. (U.S. 6,175,645).

Claim 28 depends from claim 26. Claim 33 depends from claim 31. Claim 71 depends from claim 69. Claim 76 depends from claim 74. Claims 26, 31, 69 and 74 have been distinguished over Hara and Caspi for reasons advanced above. Inasmuch as claims 26, 31, 69 and 74 are deemed patentable, Applicants respectfully submit that claims 28, 33, 71 and 76 are

also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claims 28, 33, 71 and 76.

Claim 68 stands rejected under 35 U.S.C. §103 (a) as being unpatentable over Hara et al. (U.S. 4,692,690) in view of Bishop et al. (U.S. 5,524,152).

Claim 68 depends from claim 44. Claim 44 has been amended and has been distinguished over Hara et al. for reasons advanced above. Inasmuch as claim 44 is deemed patentable, Applicants respectfully submit that claim 68 is also patentable. Applicants respectfully request that the Examiner withdraw this rejection of claim 44.

Conclusion and Request for Interview

In view of the foregoing, this application is believed to be in order. Reconsideration and allowance of this application are respectfully solicited.

If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly invited to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,

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